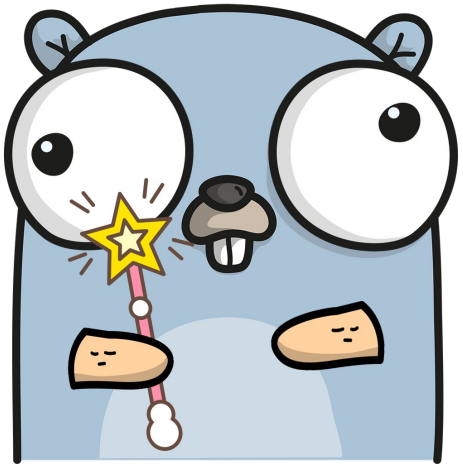

Continuous Delivery and Tooling in Go

Benjamin Muschko

O'REILLY®

About the trainer

bmuschko

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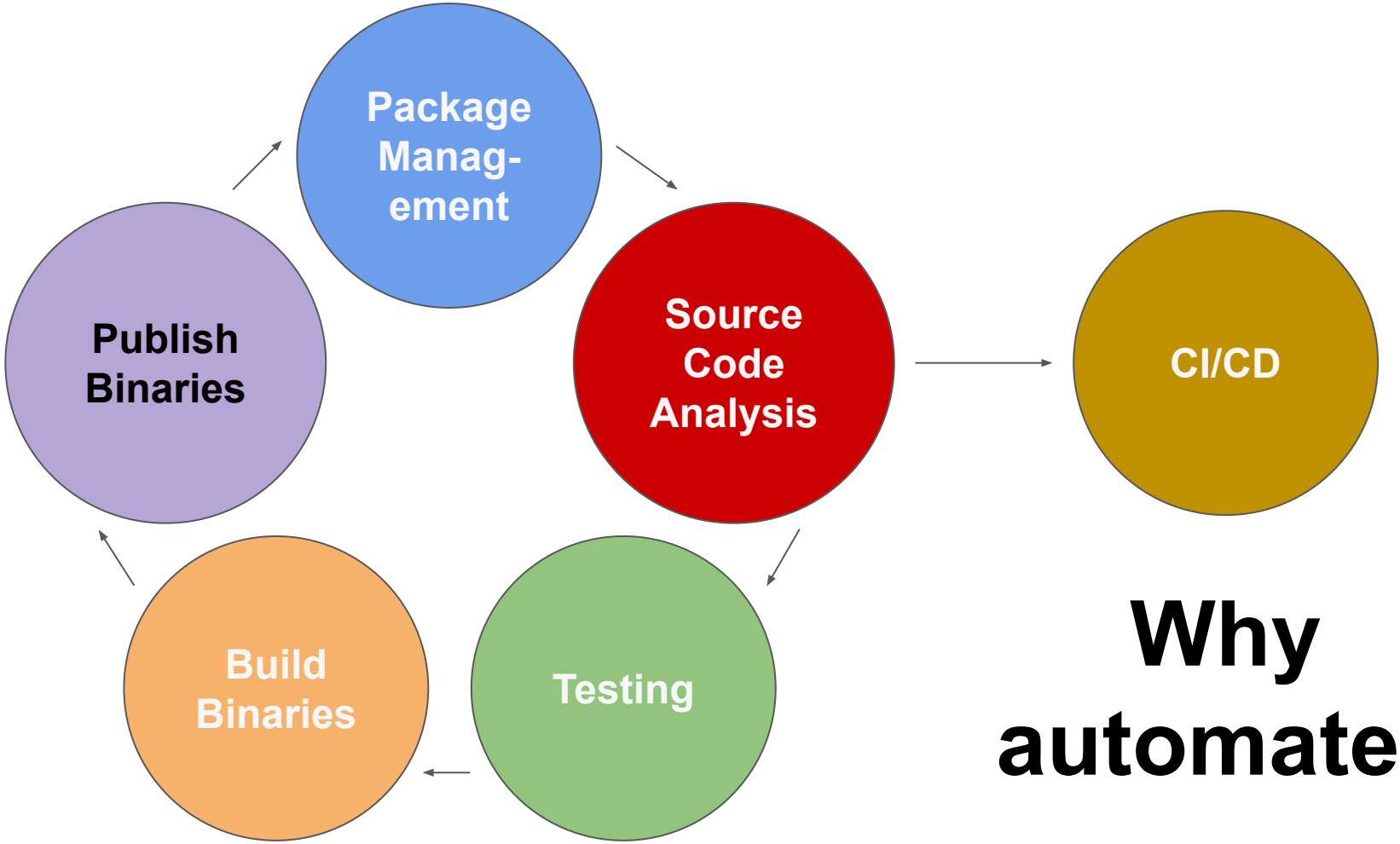
AUTOMATED ASCENT

automatedascent.com

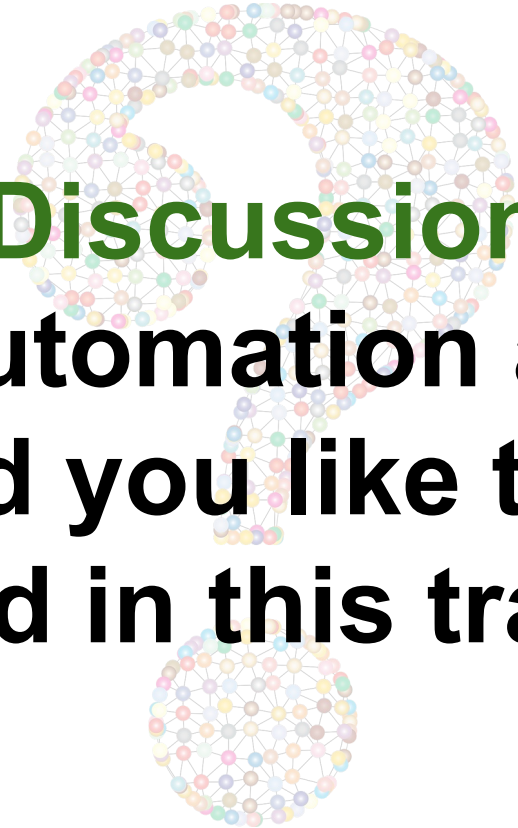
Training Objectives

Agenda

- Source code analysis
- Package management
- Implementing and executing tests
- Building deliverable artifacts
- Publishing deliverable artifacts
- CI/CD for Go projects
- Wrap up and Q&A

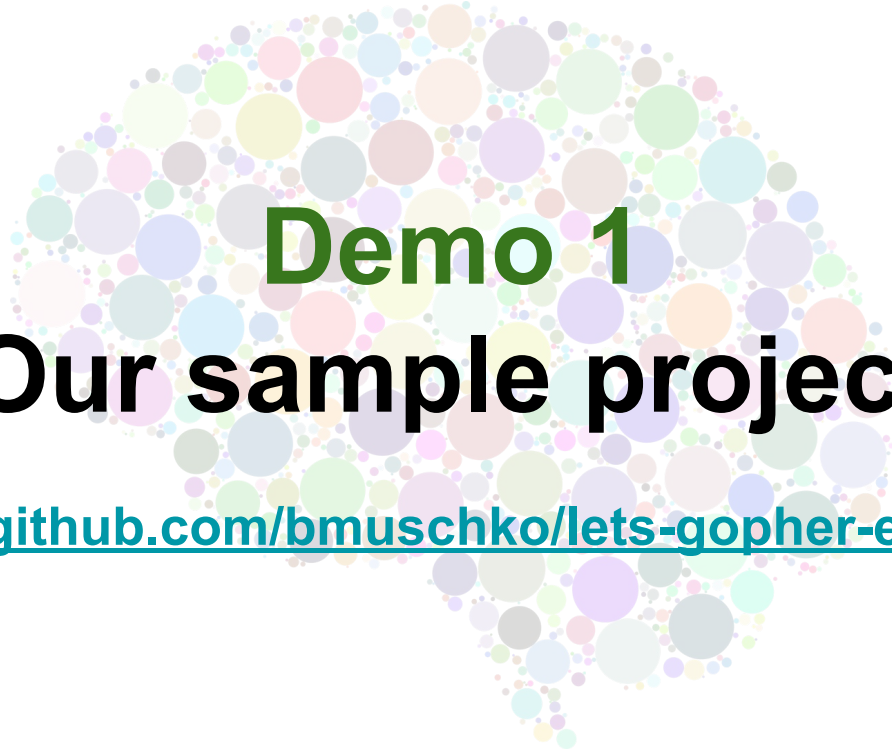


Why automate?



Discussion

What automation aspects would you like to see covered in this training?



Demo 1

Our sample project

https://github.com/bmuschko/lets-gopher-exercise

Source code analysis 1

Discussion

What analysis tools do you find useful in your projects?

Detecting common mistakes

golang.org/cmd/vet/

Part of the standard, built-in Go tooling

```
$ go vet (mypackage)
```

Current directory or provided package

Demo 2
Using Go vet

Enforcing coding style conventions

github.com/golang/lint

```
$ go get -u golang.org/x/lint/golint
```

```
$ golint
```

Path to filename, directory or package

Demo 3
Using Golint

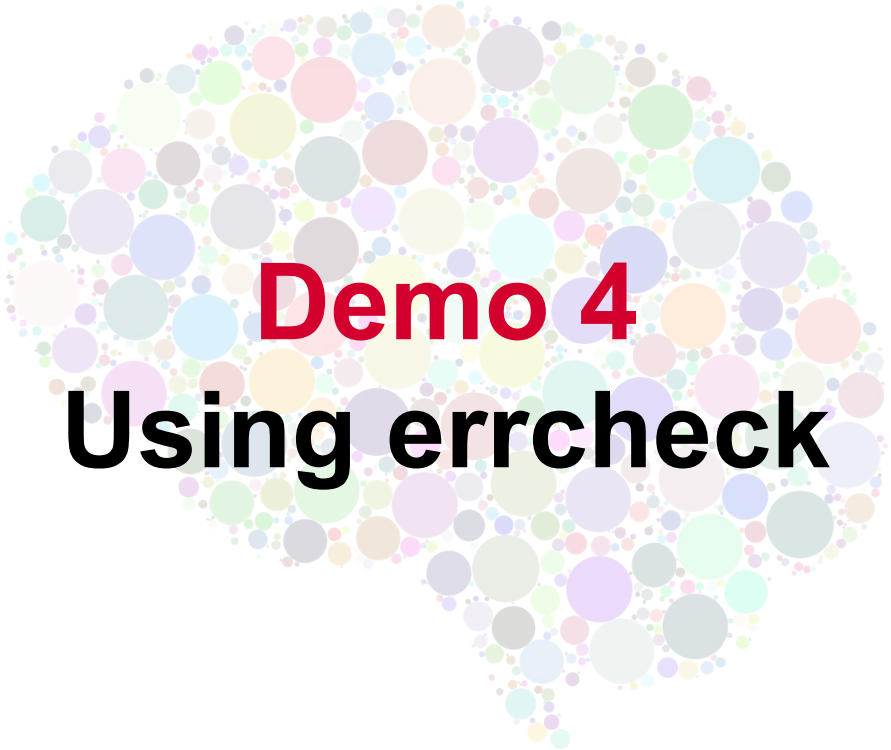
Checking for unchecked errors

github.com/kisielk/errcheck

```
$ go get -u github.com/kisielk/errcheck
```

```
$ errcheck ./...
```

All packages beneath current directory



Demo 4
Using errcheck

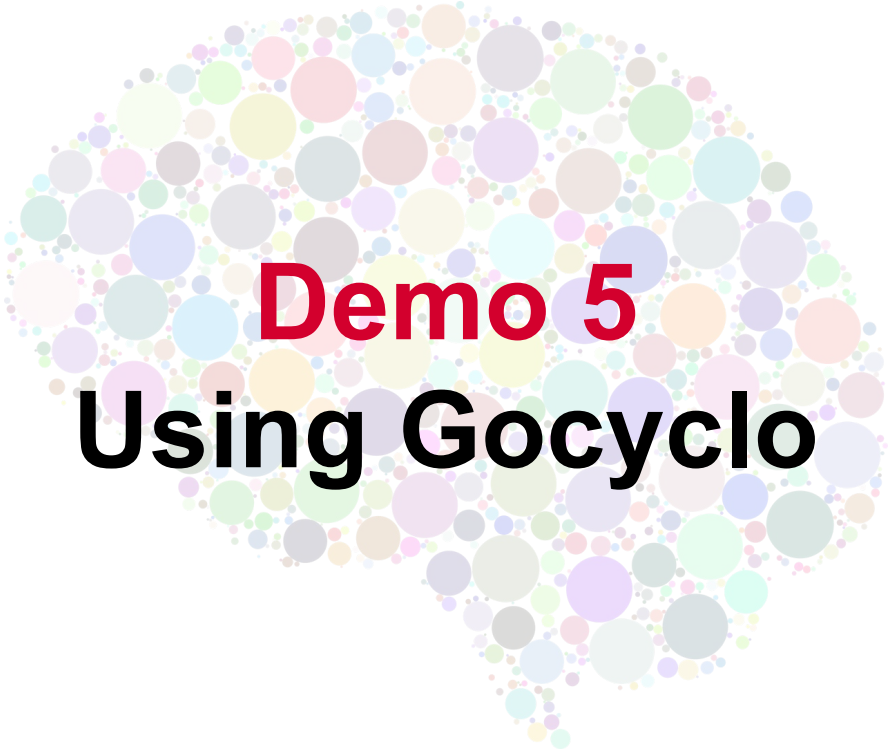
Calculating cyclomatic complexities

github.com/fzipp/gocyclo

```
$ go get -u github.com/fzipp/gocyclo
```

```
$ gocyclo .
```

All packages beneath current directory



Demo 5
Using Gocyclo

Aggregated Linting for Go projects

https://github.com/golangci/golangci-lint

Parallel execution of quality tools

Free for Open Source projects

```
$ golangci-lint run
```

IDE integration for golangci-lint

Linting on save

Uses `golint` by default

Override in `settings.json`

USER SETTINGS WORKSPACE SETTINGS

Place your settings here to override the Default Settings.

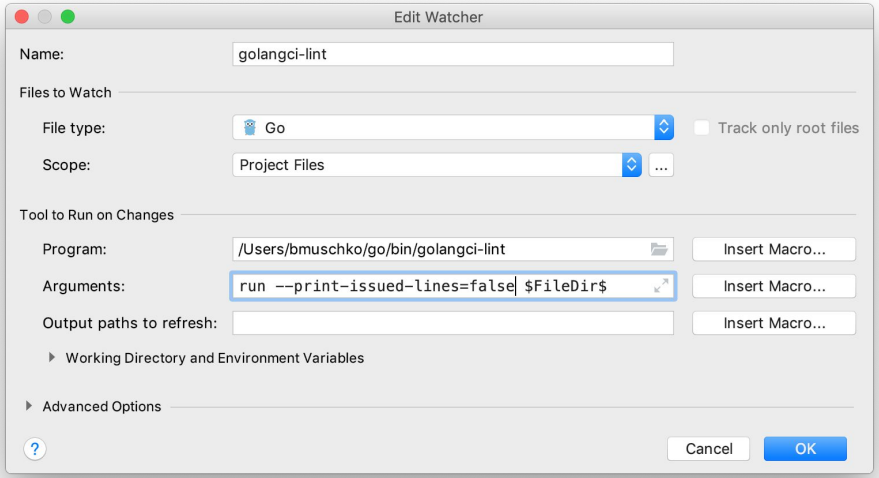
```
1  {
2      "go.lintTool":"golangci-lint",
3      "go.lintFlags": [
4          "--fast"
5      ],
6      "window.zoomLevel": 1,
7      "editor.minimap.enabled": false,
8      "editor.renderWhitespace": "all",
9      "editor.renderControlCharacters": true,
10     "breadcrumbs.enabled": true,
11     "workbench.colorTheme": "Quiet Light"
12 }
```

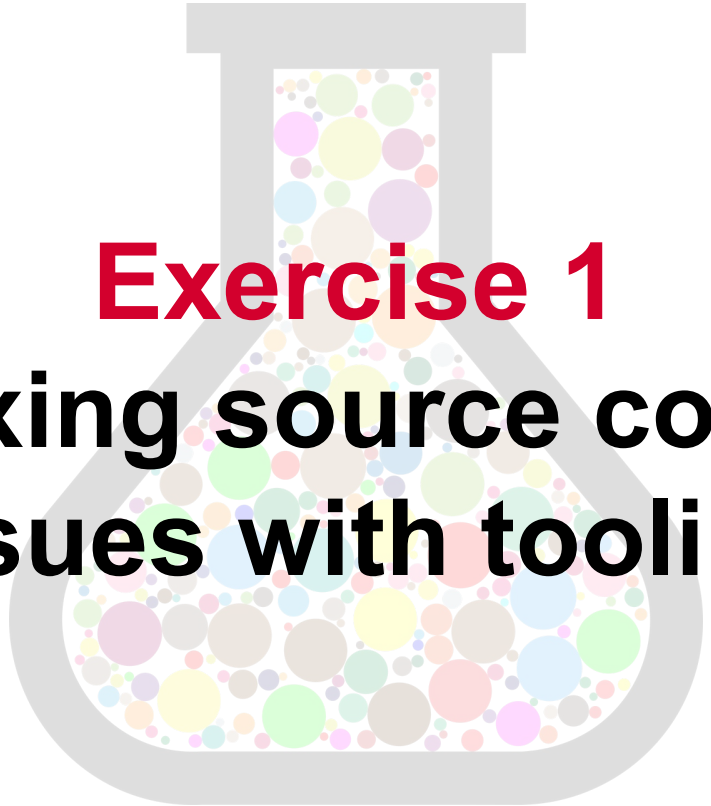
IDE integration for golangci-lint

File Watcher

Predefined File Watcher for `golangci-lint`

Available with >= 2019.1.1



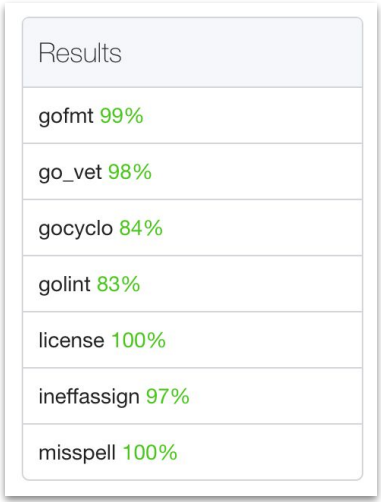


Exercise 1

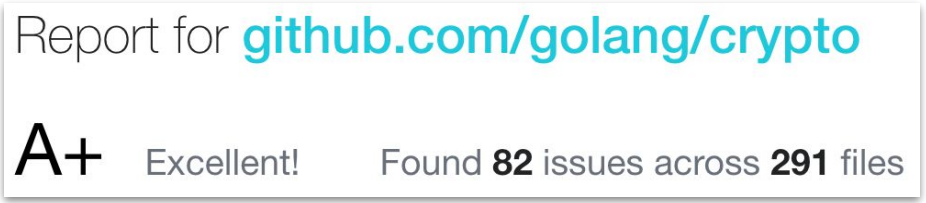
Fixing source code issues with tooling

Generating a project report

goreportcard.com/



Full integration with different tools



Report summary

Embeddable badge

Demo 6
Using Go report card

Package management 2

Discussion

What kind of package management do you use?

Options for package managers

A lot of open source choices: glide, godep, ...

Most relevant: dep and Go Modules

The new standard (>= Go 1.11): Go Modules

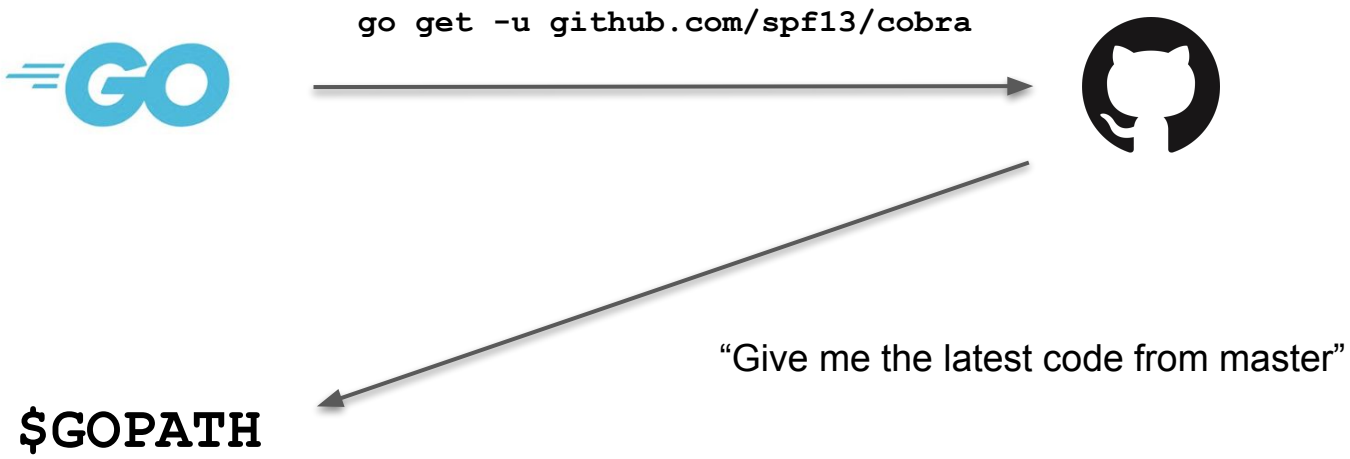
Using an external package

```
package cmd

import (
    "fmt"
    "github.com/spf13/cobra"
    "os"
)
```


References package outside of Go's internal packages

Typical workflow of go get (< Go 1.11)



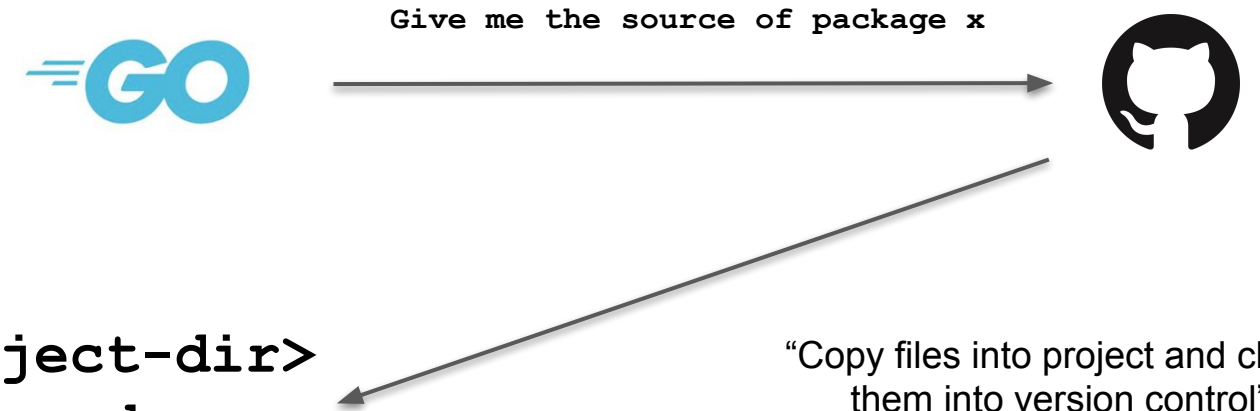
Shortcomings of go get (< Go 1.11)

“The code is currently broken on master”

“Will I get the same code in 3 months?”

“What about transitive packages?”

Vendoring to the rescue



Go Modules - high level usage

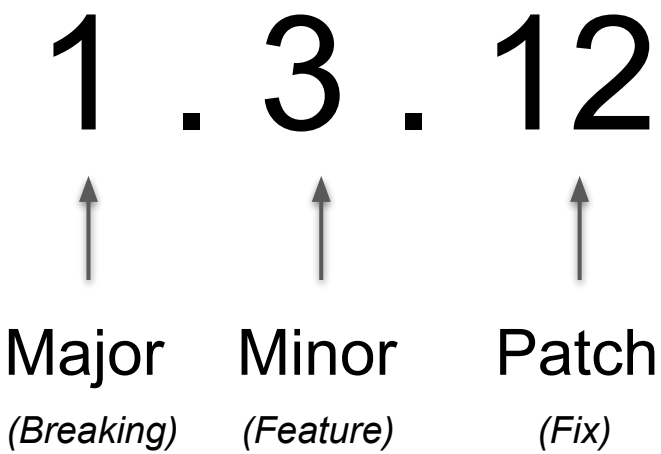
Enabled by setting `GO111MODULE=on`

Check in generated `go.mod`, `go.sum`

Direct integration with `go get`

Semantic versioning to identify release

semver.org/



Dependency declaration

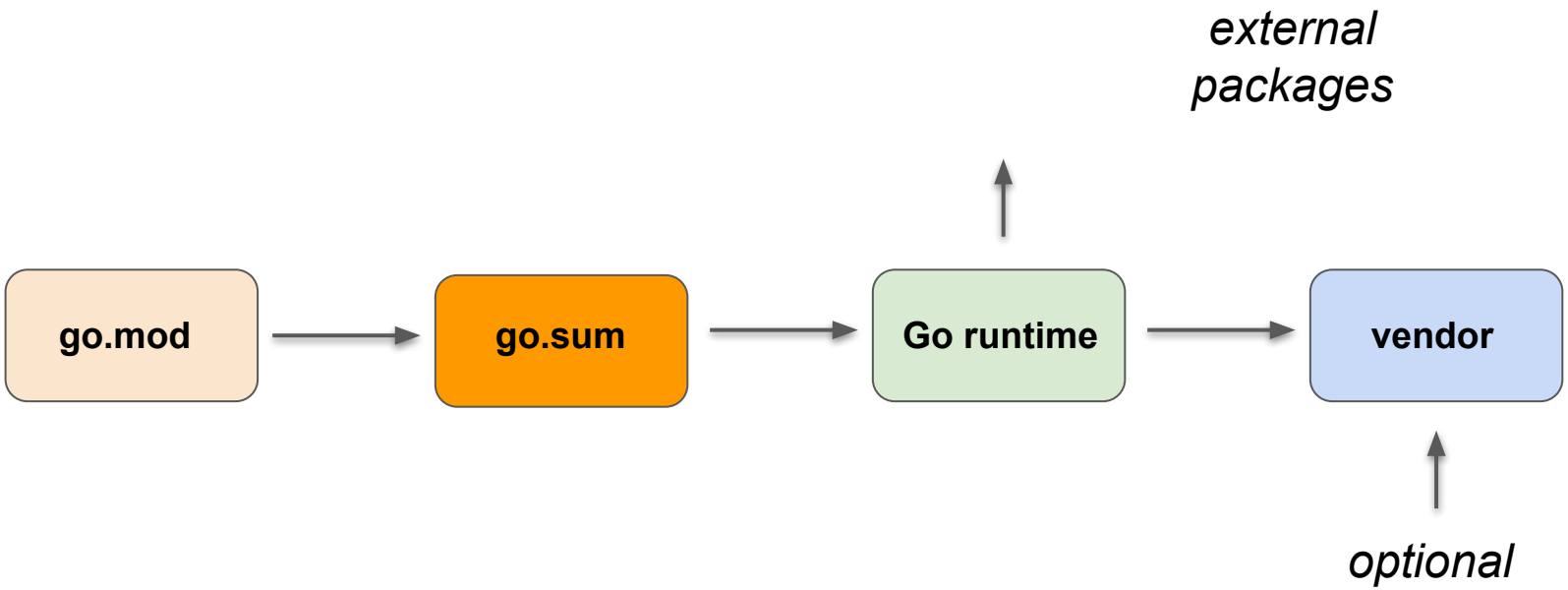
```
module github.com/bmuschko/letsgopher

require (
     github.com/Flaque/filet v0.0.0-20190209224823-fc4d33cfcf93
     github.com/blang/semver v3.5.1+incompatible
     github.com/ghodss/yaml v1.0.0
     github.com/gosuri/uitable v0.0.0-20160404203958-36ee7e946282
     github.com/inconshreveable/mousetrap v1.0.0 // indirect
     ...
)

go 1.13
```

go.mod

Building blocks



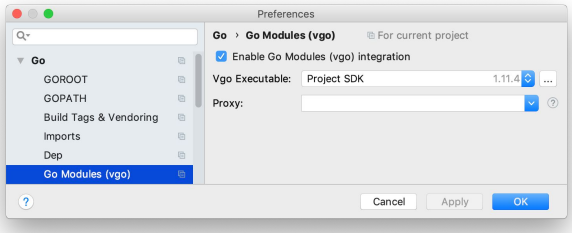
Workflow: Starting a new project

1. Create new project, set env. variable
2. Run `go mod init`, add pkg with `go get`
3. Check in generated `go.mod`, `go.sum`

IDE integration for Go modules

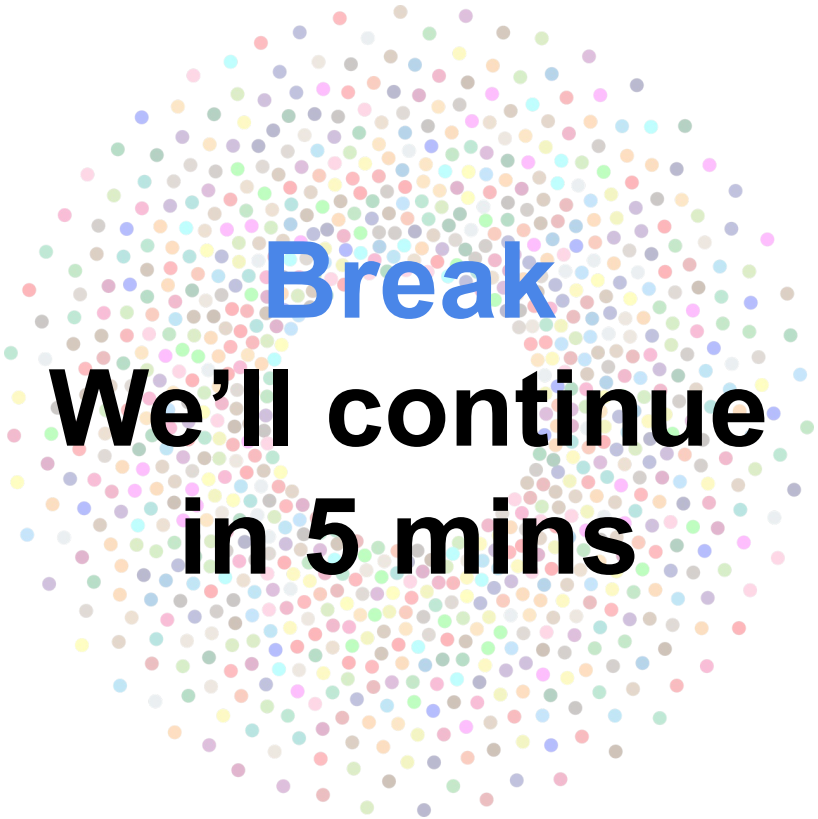
Early support, change of `settings.json`

Built-in support can run even run `mod` commands

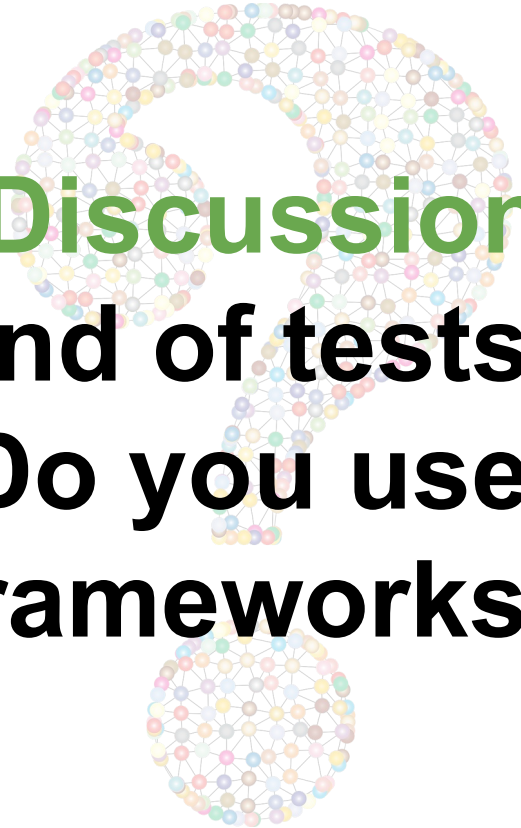


Exercise 2

Declaring and resolving dependencies


Break
We'll continue
in 5 mins

Efficient testing 3



Discussion

What kind of tests do you write? Do you use testing frameworks?

Using the standard testing package

Built-in feature of Go library

Easy to understand, no syntactic sugar

No convenient assertion statements

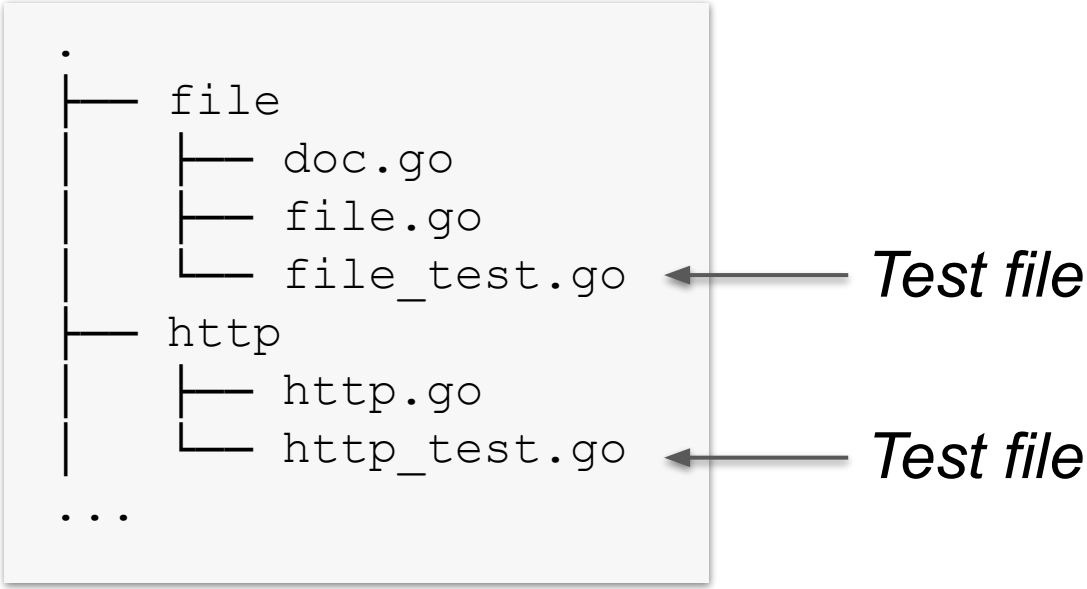
Basic guidelines for organizing tests

Create test file alongside prod. source code

Use convention `*_test.go` for test file name

Only test public API by using different package

Example of test file organization



Implementing a simple test

```
package calc_test

import (
    . "github.com/bmuschko/go-testing-frameworks/calc"
    "testing"
)

func TestAddWithTestingPackage(t *testing.T) {
    result := Add(1, 2)

    if result != 3 {
        t.Errorf("Result was incorrect, got: %d, want: %d.", result, 3)
    }
}
```

Using the testing API

Test function name starts with `Test`

Only parameter for function is `t *testing.T`

Call `t.Error` or `t.Fail` to indicate a failure

Executing tests including coverage

```
$ go test ./... -cover
?   github.com/bmuschko/link-verifier        [no test files]
?   github.com/bmuschko/link-verifier/cmd    [no test files]
ok  github.com/bmuschko/link-verifier/file   0.023s   coverage: 94.7%↵
of statements
ok  github.com/bmuschko/link-verifier/http   0.536s   coverage: 100.0%↵
of statements
ok  github.com/bmuschko/link-verifier/stat   0.020s   coverage: 100.0%↵
of statements
ok  github.com/bmuschko/link-verifier/text   0.035s   coverage: 100.0%↵
of statements
?   github.com/bmuschko/link-verifier/verify [no test files]
```

IDE integration in VSCode

Ability to run and debug tests

IDE integration in GoLand

Ability to run and debug tests

Exercise 3
Implementing a simple test

Capturing code coverage metrics

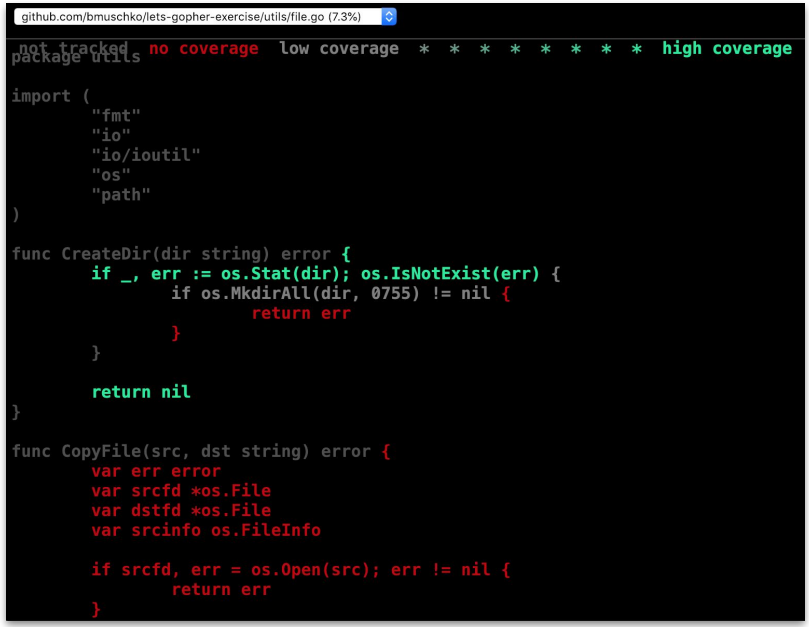
```
$ go test ./... -coverprofile=coverage.txt -covermode=count
ok   github.com/bmuschko/go-testing-frameworks/calc  3.610s
```

Vendor directory excluded with Go 1.9+

Write metrics to `coverage.txt` for processing

Rendering coverage HTML report

```
$ go tool cover -html=coverage.txt
```

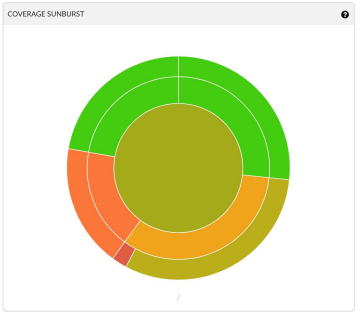


Honestly not the most visually appealing!

Coverage visualization with Codecov

codecov.io/

Files					Coverage
file	30	24	2	4	80.00%
http/http.go	16	12	1	3	75.00%
stat/stat.go	20	20	0	0	100.00%
text/parse.go	24	24	0	0	100.00%
Project Totals (5 files)	90	80	3	7	88.88%




```
$ bash <(curl -s https://codecov.io/bash)
```

Other testing frameworks

Comparison: bmuschko.com/blog/go-testing-frameworks/

Testify: Assertion and mock helper functions

Ginkgo: BDD framework + assertion helpers

Benefits of Testify

Reduction of code duplication

Readable and standardized error messages

Creation of stand-in objects

Testify comparison assertion

godoc.org/github.com/stretchr/testify/assert#Equal

func Equal

```
func Equal(t TestingT, expected, actual interface{}, msgAndArgs ...interface{}) bool
```

Equal asserts that two objects are equal.

```
assert.Equal(t, 123, 123)
```

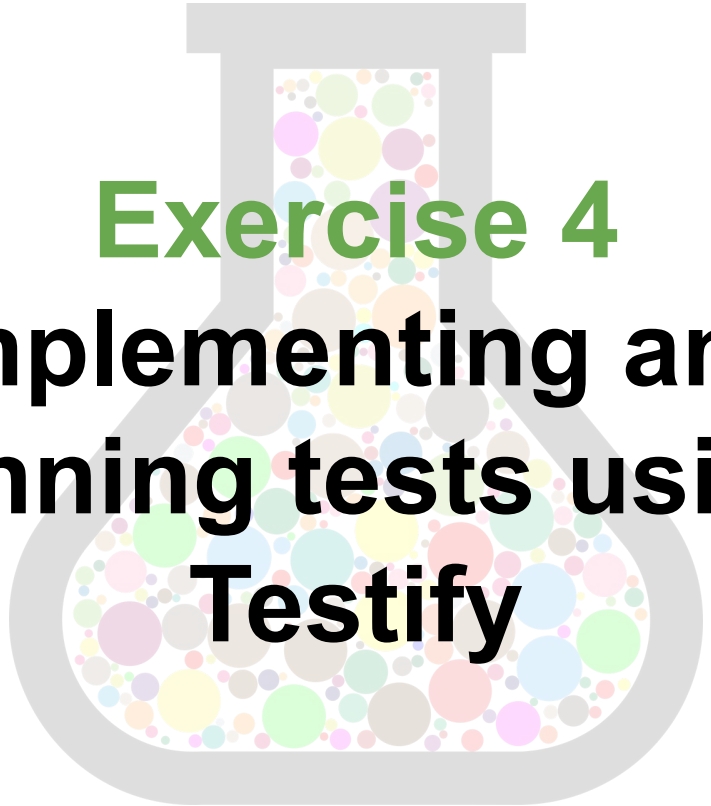
Pointer variable equality is determined based on the equality of the referenced values (as opposed to the memory addresses). Function equality cannot be determined and will always fail.

Using a Testify assertion

```
package calc_test

import (
    . "github.com/bmuschko/go-testing-frameworks/calc"
    . "github.com/stretchr/testify/assert"
    "testing"
)

func TestAddWithTestify(t *testing.T) {
    result := Add(1, 2)
    Equal(t, 3, result)
}
```



Exercise 4

Implementing and running tests using Testify

Benefits of Ginkgo

Expressive test definition (given/when/then)

Optional assertion library Gomega Ω

Color-coded console output

Implementing a scenario with Ginkgo

```
package calc_test

import (
  . "github.com/bmuschko/go-testing-frameworks/calc"
  . "github.com/onsi/ginkgo"
  . "github.com/onsi/gomega"
)

var _ = Describe("Calculator", func() {
  Describe("Add numbers", func() {
     Context("1 and 2", func() {
        It("should be 3", func() {
           Expect(Add(1, 2)).To(Equal(3))
        })
     })
  })
})
```

Defining a test suite

```
package calc_test

import (
    "testing"
)

func TestCalc(t *testing.T) {
    RegisterFailHandler(Fail)
    RunSpecs(t, "Calculator Suite")
}
```

Color-coded console output

```
=== RUN   TestCalc
Running Suite: Calculator Suite
================================
Random Seed: 1528760387
Will run 4 of 4 specs

••••
Ran 4 of 4 Specs in 0.000 seconds
SUCCESS! -- 4 Passed | 0 Failed | 0 Pending | 0 Skipped
--- PASS: TestCalc (0.00s)
```

Building artifacts 4

Rendering docs on local machine

Documentation server on localhost

Renders anything in all packages in `GOPATH`

Option to render docs on console

```
$ godoc -http=:6060
```

Rendering docs from CLI

Docs for package, const, func, type, var, method

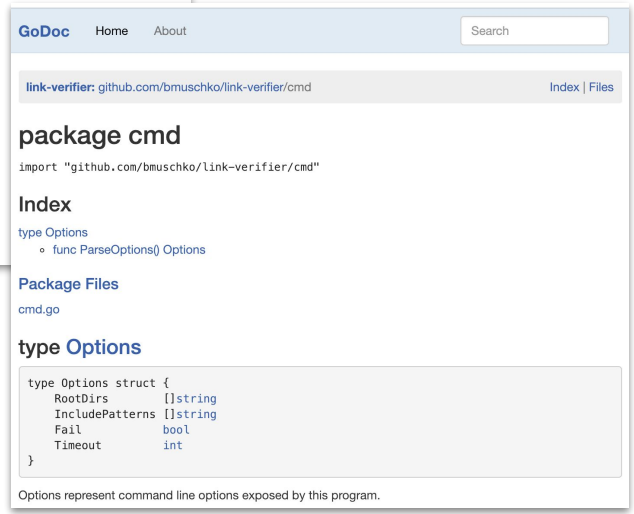
Primary and only use from CLI

```
$ go doc stat.SumFailures
```

Building artifacts

The godoc.org website

```
// Options represent command line options exposed by this program.
type Options struct {
        RootDirs        []string
        IncludePatterns []string
        Fail            bool
        Timeout         int
}
```



Publicly-searchable documentation for go packages

Assembling cross-platform binaries

Executables for platforms & architectures

Optimized for performance & includes deps

`go build` + `GOOS` and `GOARCH` env vars

Options for creating binaries

Write a script to automate CLI invocations

Gox: Parallelize builds for multiple platforms

GoReleaser: Binary creation and releasing

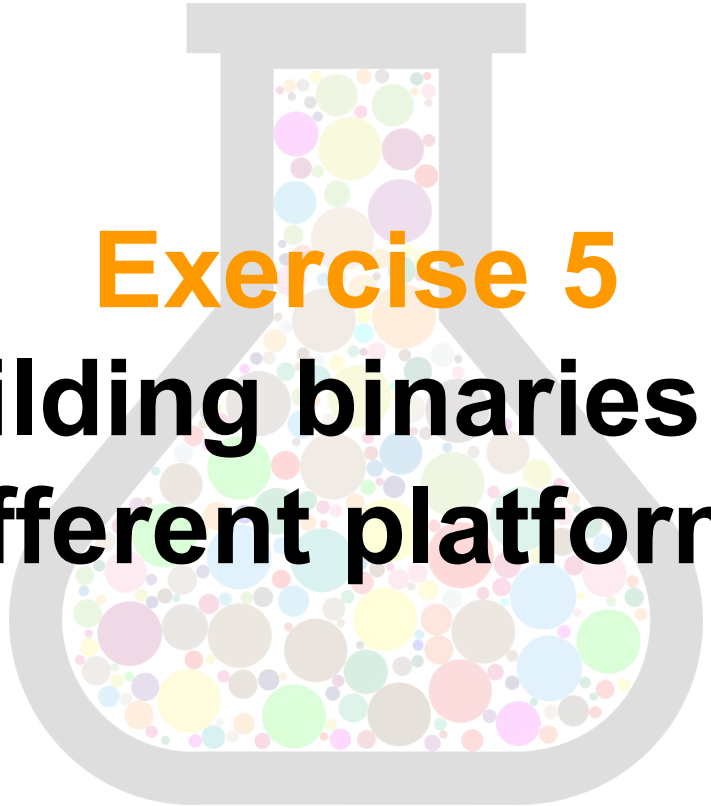
Simplifying cross-compilation with Gox

github.com/mitchellh/gox

Supports all possible platforms

Parallelized execution based on CPUs/cores

```
$ gox -osarch="linux/amd64"
```



Exercise 5

Building binaries for different platforms


Break
We'll continue
in 5 mins

Publishing artifacts 5

Making executables consumable

Versioned binaries for end users

Appropriate hosting platform

An option for public projects: GitHub releases

Publishing artifacts

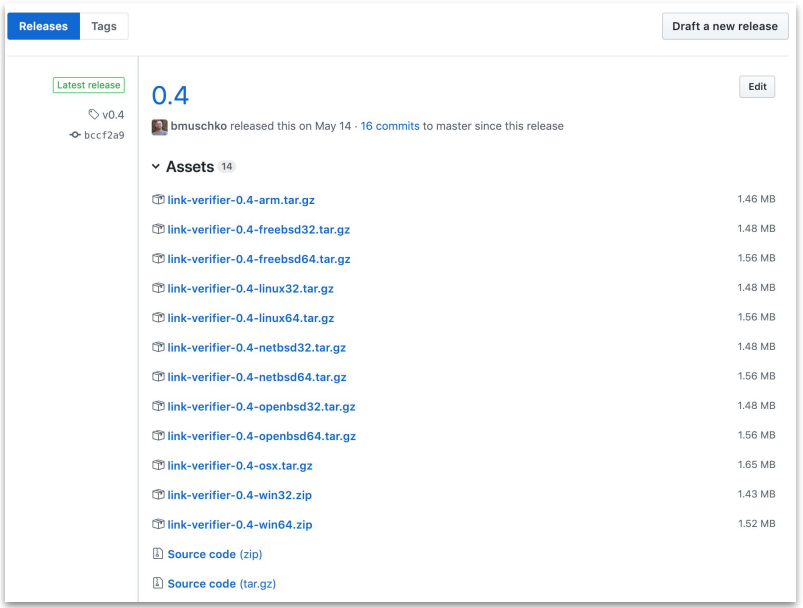
GitHub releases

Tag version

Release title

Binaries

Release notes



Different tooling options

ghr : Creates GitHub release/uploads in parallel

github-release: Create/delete releases on Github

GoReleaser: Builds/release binaries for platforms

Using GoReleaser to publish to GitHub

Definition in `.goreleaser.yml`

Combination of OS and architecture

Automatic generation of changelog

Exercise 6

Publishing binaries to GitHub

Publishing to binary repository

Hosting artifacts within enterprise boundaries

Artifactory for ensuring security & confidentiality

GoReleaser integrates with Artifactory

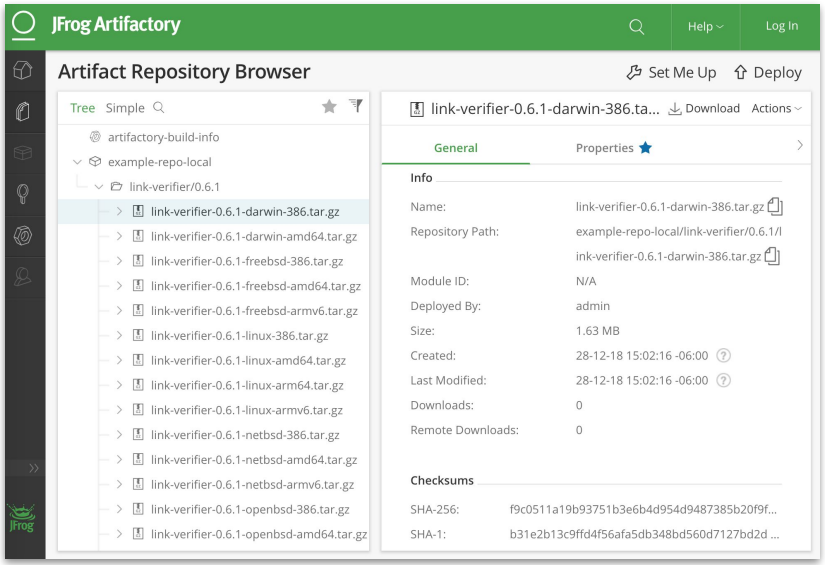
Using GoRereleaser to publish to Artifactory

```
release:
  disable: true
artifactories:
- name: production
  target: http://localhost:8081/artifactory/↲
          example-repo-local/{{ .ProjectName }}/↲
          {{ .Version }}/
  username: admin
```

Providing credentials as env. variables

ARTIFACTORY_PRODUCTION_USERNAME

ARTIFACTORY_PRODUCTION_SECRET



Demo 7
Publishing artifacts to Artifactory

CI/CD for Go projects 6

Discussion

What’s your approach to project automation?

On the importance of project automation

Avoid manual steps, reproducibility

Continuous integration of code commits

Ensuring a releasable state of binaries

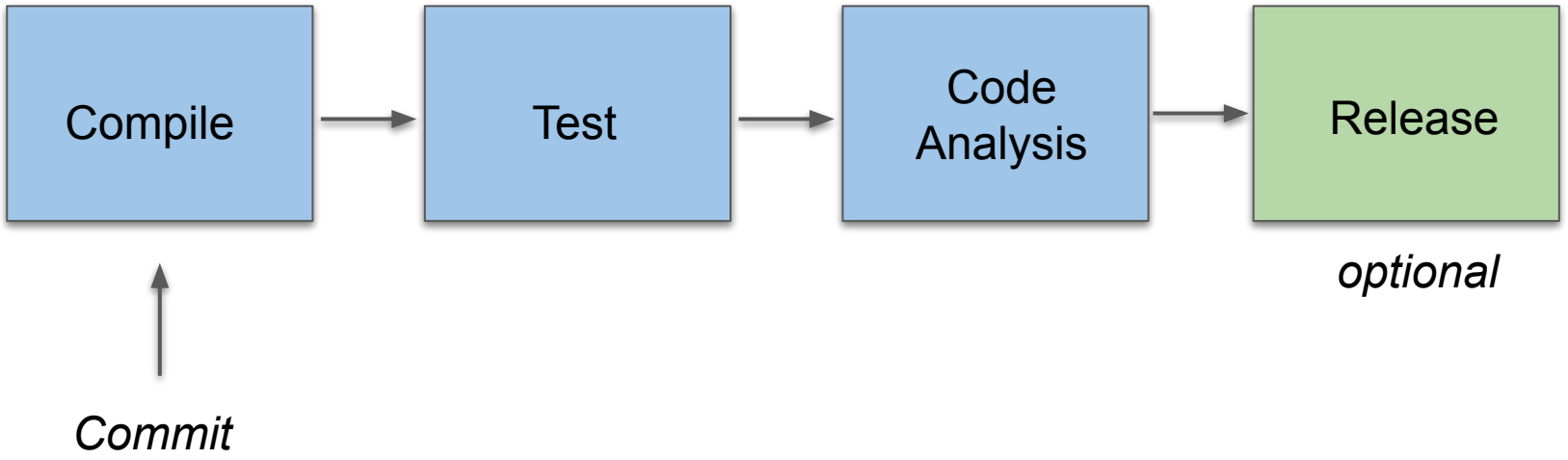
Different tooling options

Travis CI: Hosted free and paid on-prem solution

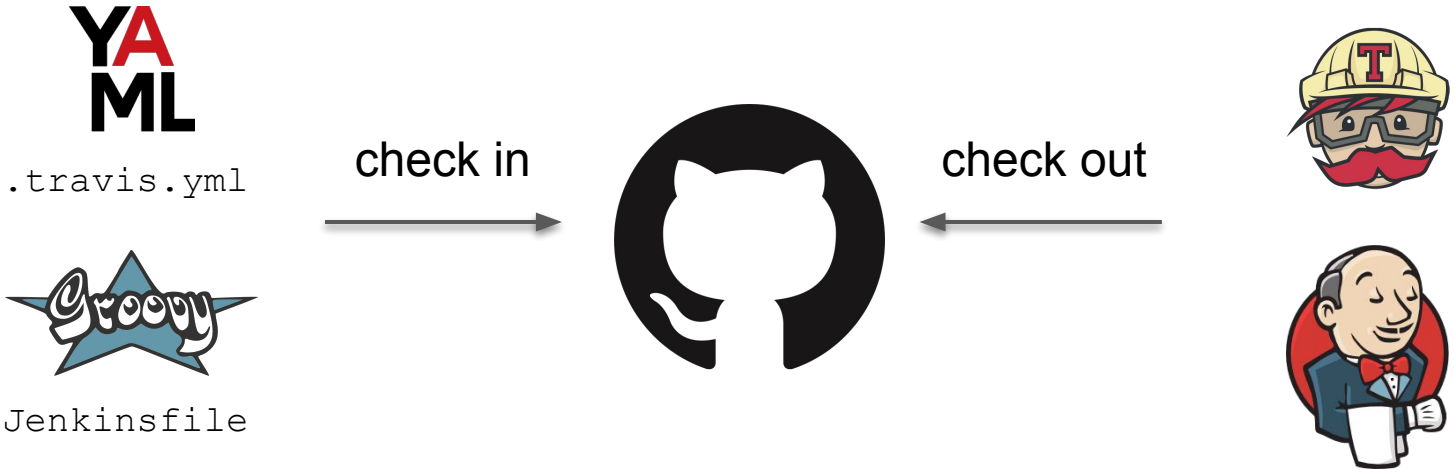
Jenkins: Free and commercial solution

...and many others like Drone, Circle CI

The delivery pipeline we want to model



Modeling a build pipeline as code



Language support and Go Module tooling

```
language: go

go:
  - 1.13.x

install: true

cache:
  directories:
    - $GOPATH/pkg/mod
```

Compiling packages and dependencies

```
script:
  - go build
```

Running tests with code coverage

```
script:
  - go test ./... -coverprofile=coverage.txt

after_success:
  - bash <(curl -s https://codecov.io/bash)
```

Executing code analysis

```
before_script:
  - curl -sfL https://install.goreleaser.com↵
    /github.com/golangci/golangci-lint.sh↵
    | bash -s -- -b $GOPATH/bin v1.21.0

script:
  - golangci-lint run
```

Release binary for tagged commit

```
deploy:
 - provider: script
   skip_cleanup: true
   script: curl -sL https://git.io/goreleaser | bash
   on:
     tags: true
     condition: $TRAVIS_OS_NAME = linux
```

Using build stages

Group jobs and run them sequentially

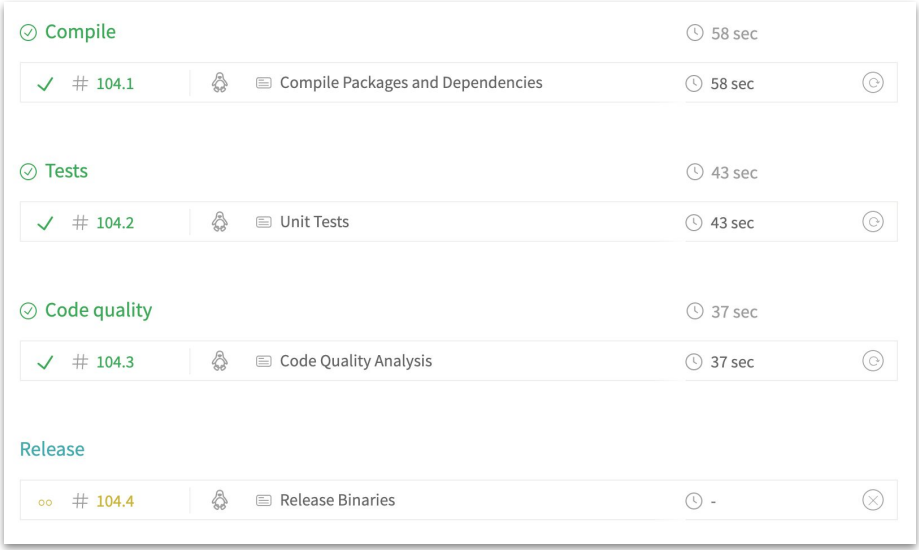
Grouped jobs can be run in parallel

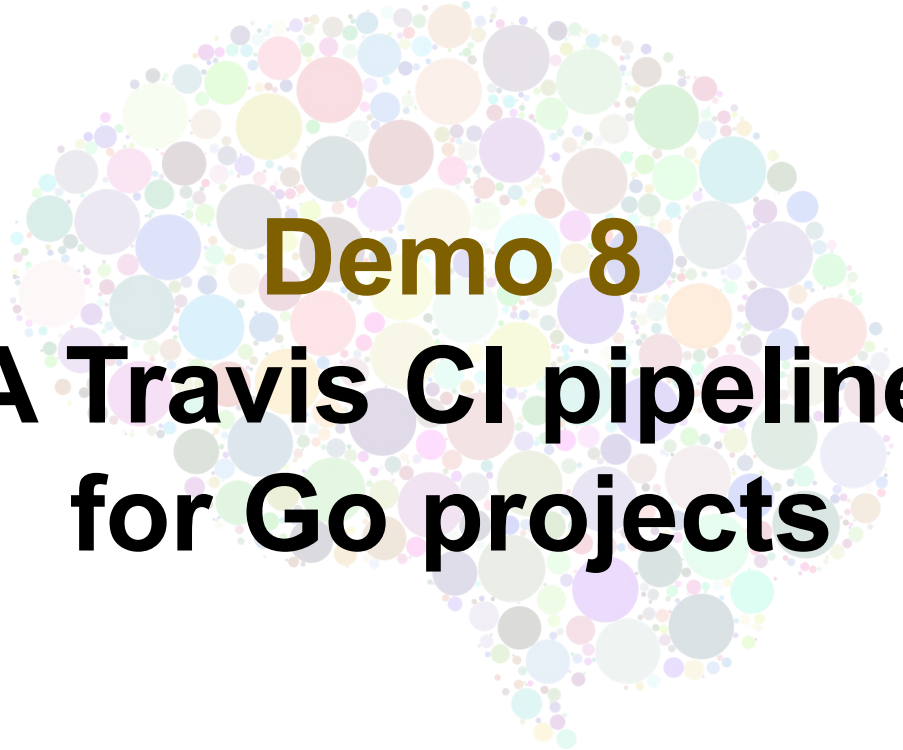
Defined in `.travis.yml`

Visualization of build pipeline

.travis.yml

```
jobs:
  include:
    - stage: ...
    - stage: ...
    - stage: ...
```

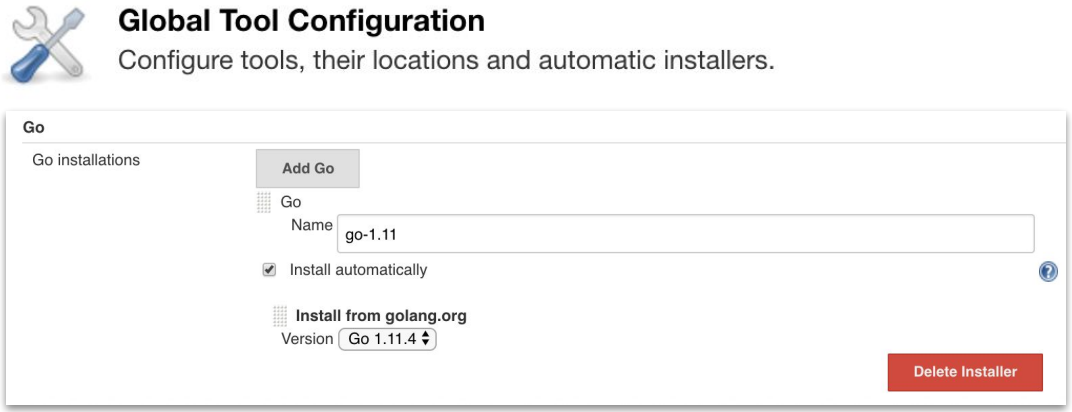




Demo 8
A Travis CI pipeline for Go projects

Automatic Go runtime installation

Taken care of by [Jenkins Go plugin]



Go tooling and environment

```
pipeline {
    agent any

    tools {
        go 'go-1.13'
    }

    environment {
        GO111MODULE = 'on'
    }
}
```

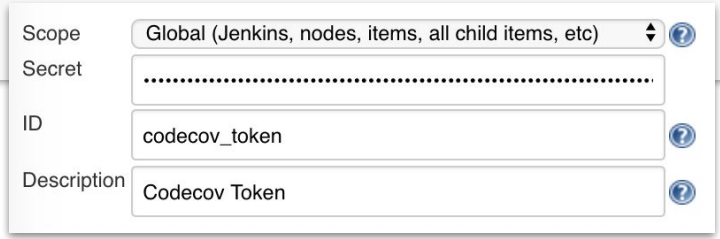
Compilation and resolving dependencies

```
pipeline {
    ...

    stages {
        stage('Compile and Resolve Dependencies') {
            steps {
                sh 'go build'
            }
        }
    }
}
```

Running tests with code coverage

```
stage('Test') {
    environment {
        CODECOV_TOKEN = credentials('codecov_token')
    }
    steps {
        sh 'go test ./... -coverprofile=coverage.txt'
        sh 'curl -s https://codecov.io/bash | bash -s -'
    }
}
```



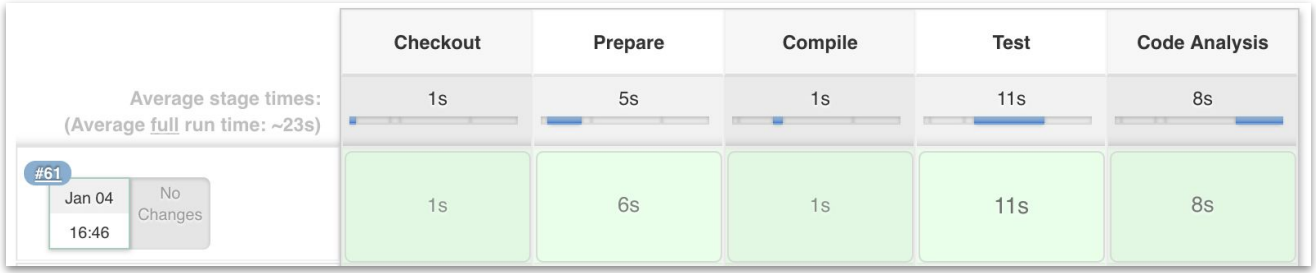
Executing code analysis

```
stage('Code Analysis') {
    steps {
        sh 'curl -sfL https://install.goreleaser.com/↲
            github.com/golangci/golangci-lint.sh | bash -s↲
            -- -b $GOPATH/bin v1.21.0'
        sh 'golangci-lint run'
    }
}
```

Release binary for tagged commit

```
stage('Release') {
    when {
        buildingTag()
    }
    environment {
        GITHUB_TOKEN = credentials('github_token')
    }
    steps {
        sh 'curl -sL https://git.io/goreleaser | bash'
    }
}
```

Visualization of build pipeline



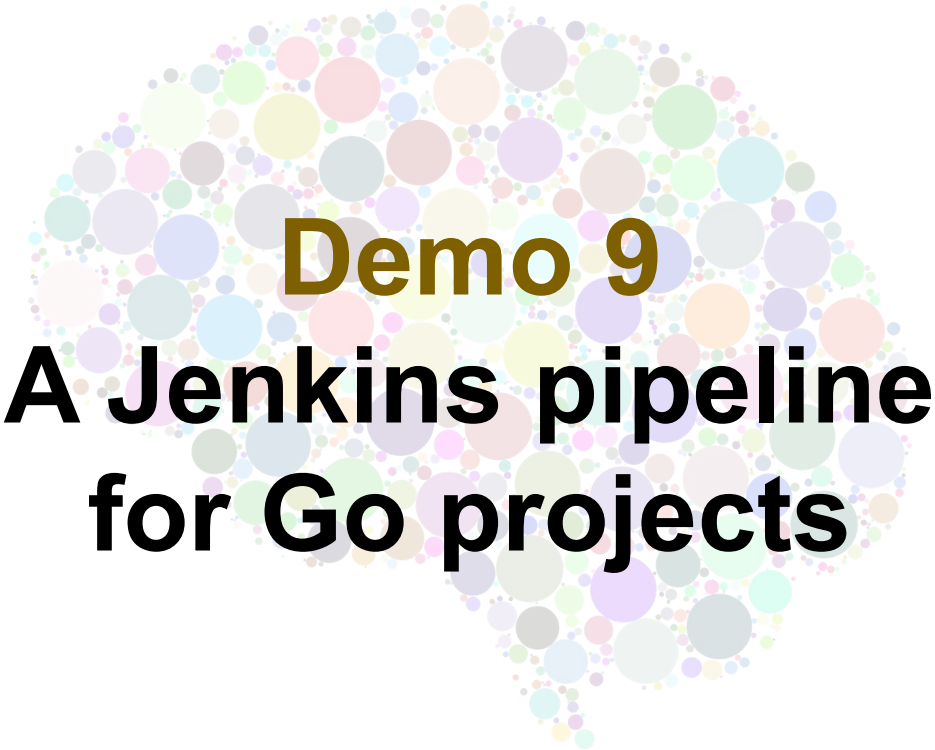
Standard

Blue Ocean

Jenkinsfile IDE support

Jenkins Pipeline Linter Connector

Jenkinsfile language support



Demo 9
A Jenkins pipeline for Go projects

Sample pipeline definitions

Travis CI: using Go modules, using dep

Jenkins: using Go modules, using dep

Q & A

Thanks for attending.
Please ask questions!